PREFACE

On-demand computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources. It provides several services. On-demand computing based transaction processing is one of them which deals with the challenge to an enterprise to meet fluctuating demands of sufficient resources efficiently. Concepts such as grid computing, utility computing, autonomic computing, cloud computing and adaptive management seem very similar to the concept of on-demand computing. On-demand computing, which is a form of distributed computing involves coordination and sharing of computing resources across the web globally. On-demand computing based transaction is a group of operations executed in on-demand computing platform to perform some specific functions by accessing and updating a database. It consists of various service calls executed by different peers of on-demand computing environment. It is one of such applications which are widely needed as an effective means by sharing a large number of resources among different organizations. On-demand computing based transaction is a distributed transaction which is also referred to as global transaction. It includes a main transaction and sub-transactions located in distributed sites. The work of the main transactions is to initiate, commit and abort the transactions, while the work of the sub-transactions is to complete access operations on the response of the site database. All the transactions, either they are sub-transactions or they are global transactions, have to satisfy the ACID (Atomicity, Consistency, Isolation, Durability)[1] characteristics. On-demand computing system may face several types of failures such as hardware failure, software failure, deadline-miss

[1] Atomicity: In a transaction involving two or more discrete pieces of information, either all of the pieces are committed or none are. Consistency: A transaction either creates a new and valid state of data, or, if any failure occurs, returns all data to its state before the transaction was started. Isolation: A transaction in process and not yet committed must remain isolated from any other transaction. Durability: Committed data is saved by the system such that, even in the event of a failure and system restart, the data is available in its correct state.

failure, network failure, and Byzantine failure. Due to the occurrence of these failures in on-demand computing based transaction processing system, we might not be able to make guarantees about a resource's trustworthiness or service's reliability or performance. Therefore we need the system to be dependable. Dependability of a system is the ability of the system to avoid service failures that are more frequent and more severe than is acceptable. It is a measure of the system's availability, reliability, performability and its maintainability, and maintenance support performance. There are many ways to make the system dependable such as load balancing, task scheduling and task allocation techniques. The task scheduling and task allocation techniques may be based on heuristic as well as meta-heuristic approaches.

The overarching goal of this dissertation is to propose soft computing based load balanced scheduling and allocation techniques which can make on-demand computing based transaction processing system dependable. This dissertation shows that the soft computing based task scheduling and allocation algorithms advance the state-of-the-art by improving the reliability, availability, performability, throughput, makespan of on-demand computing based transaction processing system. First we present a transaction processing algorithm based on ant colony optimization (ACO) for load balanced transaction scheduling. We consider several parameters such as throughput, transaction miss ratio, makespan, load deviation etc. Then a task scheduling algorithm using ant colony optimization is proposed to maximize the availability. We also propose a honey bee optimization (HBO) based method to improve the performability by scheduling of load balanced transactions. In this method, first, the load of the system is balanced and then the transactions are scheduled using foraging behavior of honey bees to find the optimal solutions. Balanced task allocation is also considered one of the methods which are used to maximize the performance and reliability in the on-demand computing based transaction processing system. The balanced task allocation in such environment is known to be an NP-hard. The reliability is a measure of trustworthiness

of the system while executing the task. So, we derive the reliability formula for the on-demand computing based transaction processing system considering resource availability. We incorporate a new fault, deadline-miss fault, while modeling the formula. In order to maximize the reliability, we propose a balanced task allocation based on social spider optimization (SSO) method. The problems which we are going to solve in this thesis are discrete optimization problems.